

# I N S T R U C T I O N   M A N U A L

F O R

VIBRATING LEVEL SENSOR

MODEL: V M 4 1

V M 4 2



Revision    2012-12-14

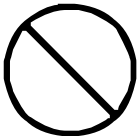

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**Read and understand this manual for safely usage.**

- This manual describes the product of standard specification. Read the other manual for the product of explosion-proof specification.
- This manual describes the handling, inspection and adjustment of the product which model is mentioned on cover page. Read and understand this manual before handling.
- Follow the additional document and/or direction, submitted by NOHKEN INC. and our distributor or agent, even if the terms are mentioned in this manual.
- Save this manual in proper place being available to refer immediately.
- The specification of product mentioned in this manual may not be satisfied by the condition of environment and usage. Check and consider carefully before using.
- Contact to sales office at NOHKEN INC. for any question or comment about this manual and product.

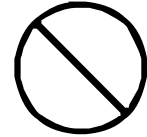
The followings are the description of the terms in this manual.

 <b>WARNING</b>	Indicates a potentially hazardous situation which, if not pay attention, could result in death, serious injury or serious disaster.
 <b>CAUTION</b>	Indicates a hazardous situation which, if not pay attention, may result in minor or moderate injury or damage to device.

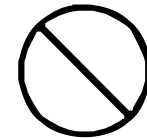
	Indicates prohibited matter. The explanation with this mark shall be followed.
	Indicates instructed matter. The explanation with this mark shall be followed.

—  **WARNING** —

This product is not explosion-proof construction. Do not install this product to the place where the flammable gas or vapor is occurred. If installed, the flammable gas or vapor may be ignited, and serious disaster may be occurred. Use the product of explosion-proof construction in this case.



Do not modify or disassemble the product. Otherwise, the product and connected device may be malfunctioned, damaged, fired, or miner injury and electric shock may be occurred. ( Follow the additional document and/or direction, submitted by NOHKEN INC. and our distributor or agent.)



Turn off the power, before wiring and inspection. Otherwise, electric leakage, fire caused by short circuit, and electric shock may be occurred.



Ensure the wire is properly connected. The product and connected device may be malfunctioned, damaged, fired, or miner injury and electric shock may be occurred by improper wiring.



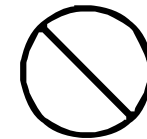
Turn off the power immediately, if the smoke, strange smell and sound are occurred.



Do not use it until the problem is solved.

—  **CAUTION** —

Avoid shock and rough handling to this product. The product may be damaged by shock as dropping, falling, throwing, knocking, lugging, and etc.



Follow the specification of operating temperature, operating pressure, switch rating, and etc. Otherwise, the product and connected device may be malfunctioned, damaged, fired, or miner injury and electric shock may be occurred. Check the manual or specification sheet.



Operation test shall be done before practical usage. If the serious accident is expected to occur by malfunction of product, the other operating principle of product shall be installed in parallel.



—  **CAUTION** —

Check and deeply consider the chemical compatibility for material of product in advance.



Hold the stem very close to mounting point, when carrying, installing, and removing. If hold the housing, it may be taken off from the flange or plug, and the product may be damaged by dropping.



Earth terminal shall be grounded to JIS Class D ground (earth resistance less than 100 Ω).  
If not grounded, electric shock may occurred by any accident.



Provide arrester or surge absorber to avoid electrical impact such as lightning and static electricity. If not provide, the product and connected device may be malfunctioned, damaged, and fired, or miner injury and electric shock may be occurred.



# INTRODUCTION

- A) This manual specifies the specification of general product. If you order special product, some details of specification may be different with the manual.
- B) We are glad to suggest and advice for Model selection and chemical resistant of material, but final decision has to be made by the customer.
- C) This manual has prepared with close attention. Ask sales office at NOHKEN INC. for any question or comment about the contents of this manual.
- D) For replacement parts  
The quality of product has frequently improved, so same spare part may not be supplied. In this case, replacement part or product may be supplied. Ask sales office at NOHKEN INC. for details.
- E) The contents of this manual are subject to change any time without notice due to the improvement of product.

# WARRANTY & DISCLAIMER

- A) NOHKEN INC. warrants this product against defect in design, material and workmanship for a period of 1(one) year from the date of original factory shipment.
- B) The warranty only covers the damage of products. The secondary and third kind disasters are not covered by NOHKEN INC.
- C) NOHKEN INC. shall not be liable for the following.
  - C-a) Do not follow the description and direction in this manual.
  - C-b) Damage due to improper installation, wiring, usage, maintenance, inspection, storing, and etc.
  - C-c) Repair and modification are done by the person who is not employee of NOHKEN INC. and our distributor or agent.
  - C-d) Improper parts are used and replaced.
  - C-e) The damage is occurred by the device or machine except our products.
  - C-f) Improper usage. (See "Proper of usage" in chapter 1 in this manual)
  - C-g) Force Majeure including, but not limited to, fire, earthquake, tsunami, lightning, riots, revolution, war, radioactive pollution, acts of God, acts of government or governmental authorities, compliance with law, regulation, and order.

THE TERMS OF WARRANTY AND DISCLAIMER SHALL IN NO WAY LIMIT YOUR REGAL LIGHT.

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# 1. PURPOSE OF USE

The vibrating level sensor, model VM41,42 types are made specifically for solid level measurement in containers. They are designed for bulk density as low as  $0.2\text{g/cm}^3$ . The model VM is usable in a wide range of specifications.

As the powder detecting point is at the tip of the detection rod, there's no malfunctions by adherence on the bin wall inside.

# 2. SPECIFICATIONS

## 2.1 Model and suffix code

Table 2-1

VM	Vibrating level sensor	
	Code	Power supply
	41	90 to 132 V AC 50/60 Hz
	42	180 to 264 V AC 50/60 Hz

## 2.2 Standard specifications

- (1) TYPE : Vibrating level sensor
- (2) MODEL : VM41, VM42 series
- (3) MEASURING OBJECT : Powder, Granular materials, Pellets.
- (4) OPERATION CHARACTERISTICS
  - (a) Detecting sensitivity : Bulk density as low as (loose)  $0.2\text{g/cm}^3$
  - (b) Operation indication : Indication of relay output: red LED
  - (c) Measuring frequency : Approx. 500 Hz
- (5) ELECTRIC CHARACTERISTICS
  - (a) Power supply : VM41 90 to 132V AC 50/60Hz  
VM42 180 to 264V AC 50/60Hz
  - (b) Power consumption : Less than 2.5VA
  - (c) Output : Relay contact 1 SPDT  
Switching delay time: Turn-on, approx. 3 sec.  
Turn-off, approx. 3 sec.
  - (d) Contact rating : 240V 3A AC (Resistive load)  
30V 3A DC (Resistive load)
  - (e) Withstand voltage : 1500V AC for one minute  
Between housing and each terminal except ground terminal
  - (f) Insulation resistance : 500V DC More than 100M  
Between housing and each terminal except ground terminal
- (6) MECHANICAL CHARACTERISTICS
  - (a) Withstand pressure : 1 MPa Max. (Except a mounting part)  
[Static pressure]
  - (b) Concentrated load : Horizontal 0.12 kN Max.  
Vertical 0.23 kN Max.  
(at the tip of the detection rod)

(7) SURROUNDING CONDITIONS

(a) Working temperature : Detecting part 0 to +60 , Housing -20 to +60  
(Get rid of dew.)

(b) Working humidity : 85 %RH Max.

(8) CONSTRUCTION : Detecting part IP68 or equivalent  
Housing IP65 or equivalent

(9) OTHERS

(a) Materials : Detecting part : 304 stainless steel,  
Brass(C3604BD, Nickel plating), Silicone

: Housing : Aluminum die casting (ADC12), ABS

(b) Mounting : Plug mounting (G 3/4)

(c) Cable inlet : G 3/4 or equivalent

(d) Mass : Approx. 1.1 kg

2.3 Dimensions

[See Fig. 2-1]

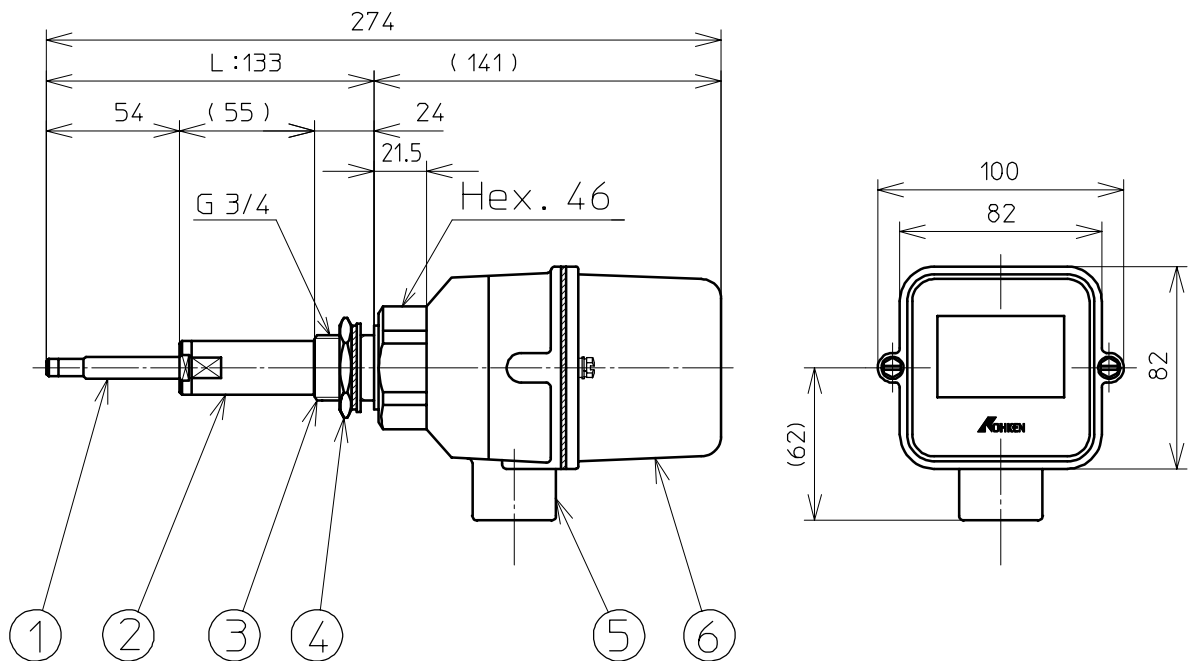


Fig. 2-1



## 2.4 Component names [See Fig. 2-1, Fig. 2-2]

### DETECTION ROD

Detecting part which touches directly to the powders. It vibrates when there's no powders, but vibration will dampen or stop when it becomes buried in the measured materials.

### EXTENSION PIPE

Sensor measuring length extension part.

### SCREW

Screw to install the sensor to the bin.

### NUT

Nut to install the sensor to the bin.

### HOUSING

Electronic circuit is placed.

### COVER

Cover for the sensor.

### GROUND TERMINAL

Ground terminal shall be grounded.

### SENSITIVITY SETTING SWITCH

To set the sensor detecting sensitivities or to check the operating condition.

### TERMINALS

Output terminal for power connection and sensor relay contact signal.

### FAIL-SAFE MODE SETTING SWITCH

To set the sensor detecting sensitivity mode and to check the operating condition.

### ALARM INDICATOR

Red lamp lights when the sensor energizes the relay.

### TEST POINT 1

The point for checking the voltage to be applied to receiving element.

### TEST POINT 2

The point for performance check and fine adjustment of sensitivity:  
[Test point 2( ) for positive (+) point and Ground terminal( ) for negative (-) point.]

### SENSITIVITY SETTING VOLUME

To set the sensor detecting sensitivities and to check the operating condition.

### TEST POINT 3

The point for checking the voltage to be applied to exciting element.

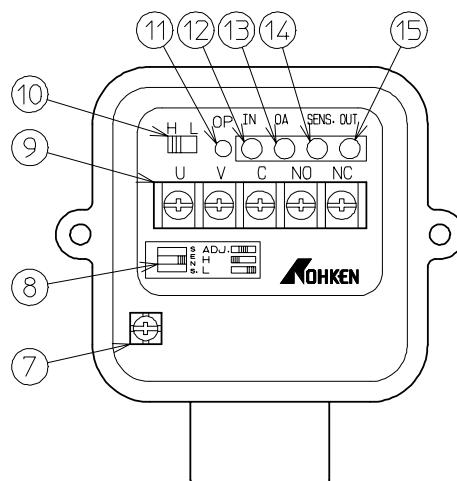


Fig. 2-2

### 3. PRINCIPLE OF OPERATION

The detection rod vibrates by installing piezo-electric element and acceleration pick-up mounted detection rod at the tip of the internal detection rod. The piezo-electric element provides vibration and the acceleration pick-up detects damp in the vibrational amplitude. Covered with solids dampens vibration of the detection rod. The electronic circuit detects the damping of these vibration and converts into the relay output.

[See Fig. 3-1]

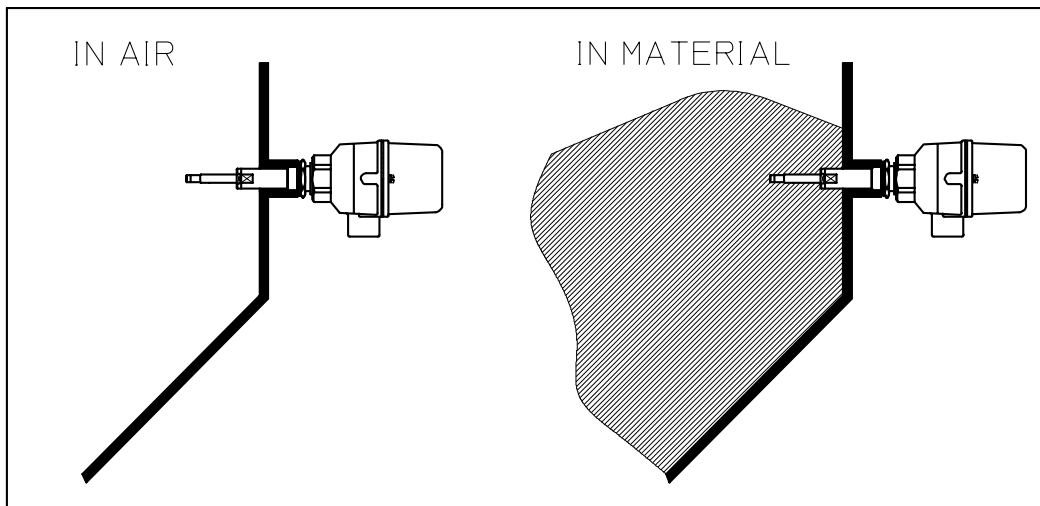


Fig. 3-1

## 4. INSTALLATION

### 4.1 Unpacking

This unit has been thoroughly inspected and carefully packed at the factory to prevent from damage during shipment. When unpacking, care must be taken not to damage the instrument with mechanical shock. After unpacking, visually check the instrument exterior for damage.

### 4.2 Installation location

This sensor should be installed in an area which meets the following conditions:

- (1) Provide ample space for maintenance/inspection.
- (2) Do not install the sensor where the temperature is high.

The highest allowance temperature for detecting part (the part which goes into the bin) is 60 . Housing's (the part out of bin) highest allowance temperature is 60 . Higher than these temperatures are not suitable for the sensors to be installed.

- (3) Do not install the sensor where it gets direct sunlight. [See Fig. 4-1]

 **CAUTION**

Install a sunshade over the housing if exposed to direct sunlight.

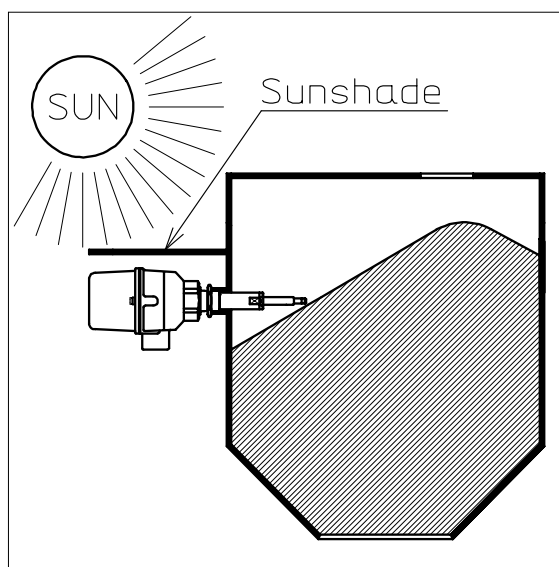


Fig. 4-1

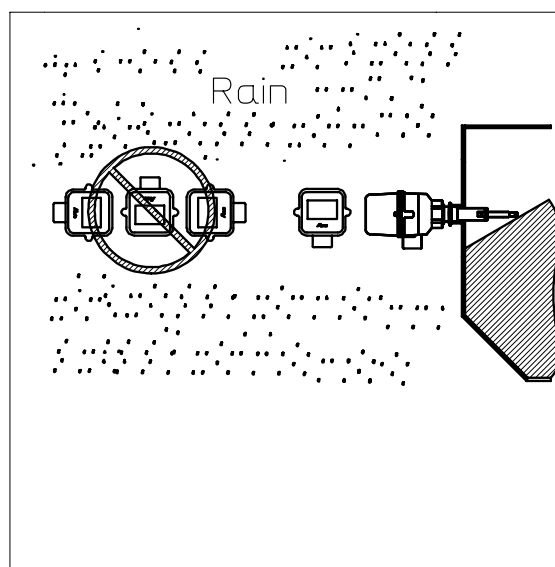


Fig. 4-2

- (4) Dew withstanding.  
Do not install in the place where ambient temperature rapidly drop (for example, 40 to 0 ). Otherwise, it may cause dew and damage the sensor.
- (5) Be attentive for the splash of water drops (rainwater) to the housing.  
The housing protection is IP54. The cable gland and cover must be properly fitted to protect the sensor from rain, splashing water, etc.  
When side-mounting, make sure the cable gland is pointing down to the ground to prevent from the rain to intrude. [See Fig. 4-2]
- (6) Do not install the sensor where corrosive gases occur.  
Most of the amplifier electronic inside the housing may corrode by the corrosive gases (such as  $\text{NH}_3$ ,  $\text{SO}_2$ ,  $\text{Cl}_2$ , etc.). Do not install in a place like this or it may cause malfunction.
- (7) Vibration is low.  
Do not install the sensor near vibrator or knocker where intensive vibration or shock occur. It may cause malfunction or the sensor will be damaged.
- (8) Non-hazardous area.  
Model VM cannot be used in an explosive atmosphere.

#### 4.3 Installation

- (1) For model VM, there is threaded type to install in the container wall.
- (2) Installing directions are horizontal mounting. Install the way it fits detecting levels.
- (3) Model VM can not be installed in any directions. The cable gland shall be installed pointing down to the ground.
- (4) The maximum load at the tip of the detection rod is 0.12 kN(Horizontal) or 0.23 kN(Vertical). If it exceeds, the detection rod will be bent.  
Install the guard at least 10cm above the detecting rod if necessary.  
[See Fig. 4-3]

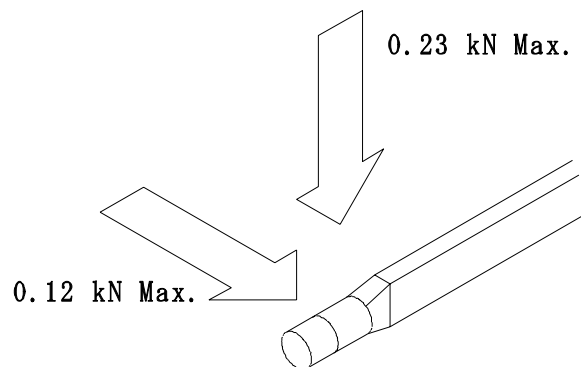


Fig. 4-3

- (5) The sensor will detect the dead stock despite there aren't any measuring materials. [See Fig. 4-4]
- (6) When used as a high level control, calculate the angle of repose for measuring materials and install the detection rod where it surely covers. [See Fig. 4-5]

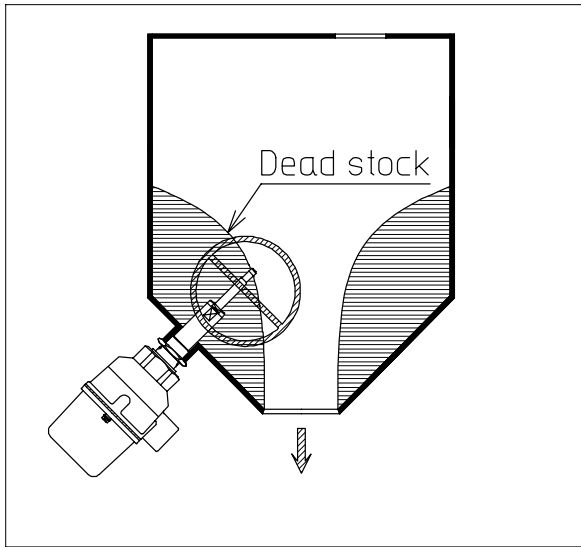


Fig. 4-4

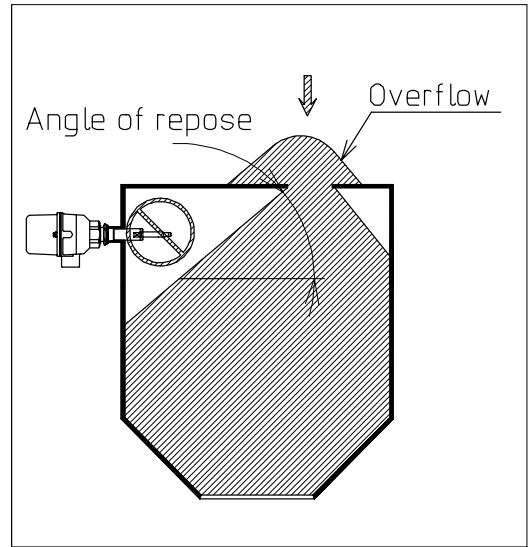


Fig. 4-5

- (7) When used as a low level control, install the guard above the detection rod as bridge or overload is anticipated.
- (8) The detection rod shall not contact with bin wall. The detection rod will not vibrate despite there aren't any measuring materials. [See Fig. 4-6]
- (9) Keep the detection rod out of the direct flow. Failure to do this may damage the sensor. Install the guard at least 10cm above the detection rod if necessary. [See Fig. 4-7]

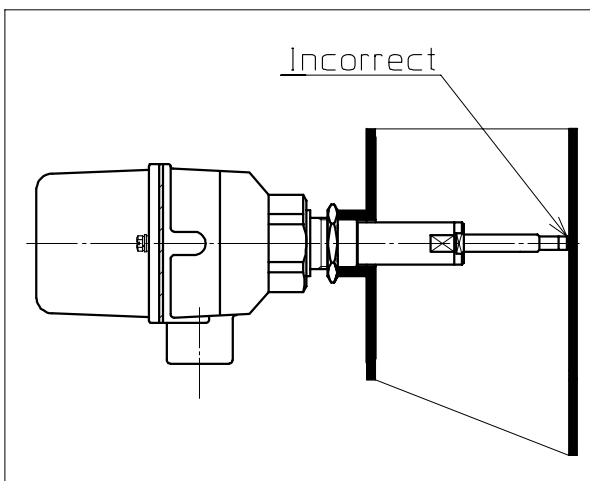


Fig. 4-6

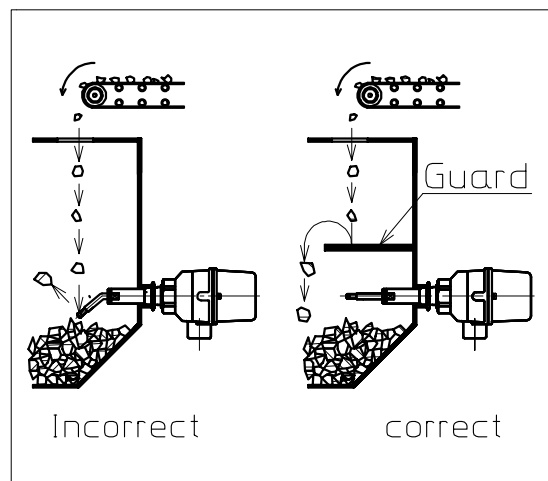


Fig. 4-7

## 5. WIRING

Proceed as follows:

- (1) Make sure the cable entry is pointing down to the ground.
- (2) Remove the housing cover.
- (3) Remove approximately 100mm of cable sheath from the end of the cable and approximately 10mm of conductor sheath.
- (4) Bring cables into the housing.

Recommended cable is as follow:

Table 5-1

Cable dimension	Cross section area of conductor	Notes	
11 to 11.9	More than 0.75mm <sup>2</sup>	Cable inlet G 3/4 or equivalent	Terminal M3.5

### ⚠ CAUTION

Tighten the cap to prevent from rain, splashing water, etc.

- (5) Connect lead wires to the terminal.
  - (a) Connect the power supply.
 

This vibrator type sensor has no power switch and fuse. If necessary install it separately. Recommended fuse is 250V, 0.5A Max.

    - If 90 to 132V AC is used, ensure model and suffix codes is VM41.  
Connect the power supplying line to U terminal and V terminal.
    - If 180 to 264V AC is used, ensure model and suffix codes is VM42.  
Connect the power supplying line to U terminal and V terminal.
  - (b) Connecting relay contact signal output terminal.

See the table below:

Table 5-2

Terminals	No material on detection rod	Material covering detection rod
NO and C	Open	Closed
NC and C	Closed	Open

### ⚠ CAUTION

The maximum relay contact is 240V AC 3A/30V DC 3A (resistive load).  
Do not connect overload. When load capacity is more than maximum contact, connect external relays between load and sensor's output terminal.

#### NOTE:

In case the power failure (blackout etc.) occurs, between C terminal and NO terminal will be de-energized and between C terminal and NC terminal will be energized.

(6) High/Low fail-safe mode

High level fail-safe mode(H.ON) means that the output relay is de-energized when the detection rod is not covered by descending material or upon power loss. Low level fail-safe mode(L.ON) means that the output relay is de-energized when the detection rod is covered by rising material or upon power loss.

By changing the fail-safe switch, the two connections can be switched from High/Low fail-safe mode. [See Fig. 5-1]

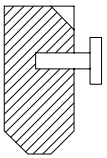

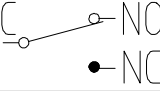

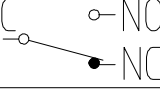
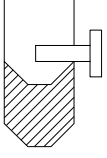

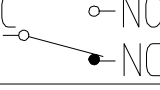

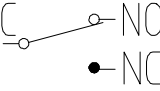

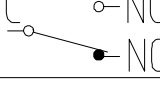
	Fail-safe mode	RELAY LAMP	Relay Contact
	H.ON		
	L.ON		
	H.ON		
	L.ON		
POWER OFF			

Fig. 5-1

(7) Ensure that there is no miswiring.

 CAUTION

Make sure the supplying voltage and the terminal written on P.C. board matches. Wrong voltage or miswiring will damage the sensor.

 WARNING

Ground terminal shall be grounded. If not, you will get an electrical shock.

(8) Re-install and tighten the cover.

## 6 . ADJUSTMENT

VM sensors require no adjustment in most cases. Use them in their delivered state. Changing the setting of switches and trimmers inside the housing can result in faulty output signals.

If one or more of the cases shown below apply, then adjust sensitivity according to the instructions in the following paragraphs:

- Sensor is having difficulty detecting material due to low apparent density or high fluidity;
- Sensor gives false outputs due to buildup;
- Switch or trimmer setting is inadvertently changed.

If problem occurs, read 8. TROUBLESHOOTING first. If it suggests sensitivity adjustment, then follow instructions in this chapter.

### 6.1 Necessary device and tool

Adjustment requires the following.

- Digital tester that can measure voltages between 0 and 10V DC.  
(Voltmeter with input resistance of 10k Min. can also be used.)
- Small slotted screwdriver for sensitivity (SENS) trimmer  
(slot on trimmer: 0.6 mm x 2.6 mm)

The outer diameter applicable to the pin for check terminal is 2mm.

### 6.2 Notes for sensitivity adjustment (check)

#### CAUTION

During adjustment (check), the sensor output can be switched.  
Before starting adjustment (check), ensure controlled devices are not adversely affected.

#### CAUTION

Apparent density changes depending on solids conditions.  
Adjust sensitivity with the sensor mounted on the same tank and using the same material as the actual application.



### 6.3 Procedure for sensitivity adjustment

- (1) Clean the detection pipe. During adjustment, ensure the pipe does not make contact with the material, or proper adjustment will not be achieved.
- (2) Supply power to the sensor, if not done yet.
- (3) Set the tester so that it reads approximately every 0.5V for voltages between 0 and 10V DC.

Place the positive probe in the OA terminal and the negative probe on the earth terminal. (See Fig. 6-1.)

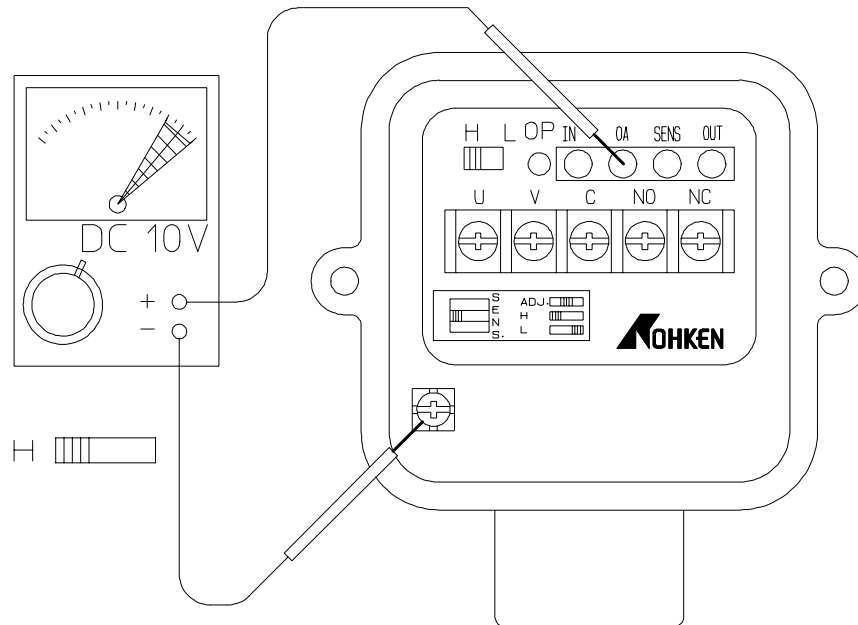


Fig. 6-1

- (4) Follow steps below to verify that the sensitivity setting has not been changed from the factory default.
  - (a) Supply power, and set the sensitivity switch to the left (H) position.
  - (b) Turn the sensitivity trimmer counterclockwise to set it to the end stop (Low sensitivity position).
  - (c) Set the failsafe switch to the left (H) position.  
Firmly grip the end of detection pipe to verify that the operation LED lights.
  - (d) With the LED on, check the tester reading to verify the OA voltage is 9V or higher.

Now the sensitivity adjustment or check is complete.

(5) Detection sensitivity adjustment

Adjust detection sensitivity following the instructions below, when an operation check reveals unstable measurement.

(a) High sensitivity setting (factory default)

The sensor may require high sensitivity setting when the sensor fails to detect material due to 0.5 or lower apparent density, or high fluidity. Ensure the sensor is set to the standard sensitivity. Then turn the trimmer to adjust sensitivity. Turning to the left reduces, and to the right increases sensitivity.

 CAUTION

Be careful not to increase sensitivity too much. Too high sensitivity setting can cause unstable operation (no vibration starts when it should, or a small external shock is required to start vibration, etc.).

(b) Low sensitivity setting

The sensor may require low sensitivity setting when the sensor fails to return to the non-detection state after detecting the material once, due to material that is adhesive and with high apparent density. Ensure the sensor is set to the standard sensitivity. With this state, set the sensitivity switch to the L position. The sensitivity will decrease. With this state, turn the trimmer to adjust sensitivity. Turning to the left reduces, and to the right increases sensitivity.

 CAUTION

Inadequately low sensitivity setting can cause the sensor to fail to detect the material.

(6) Every time the sensitivity is adjusted, check the operation with the sensor mounted on the same tank and using the same material as the actual application.

 CAUTION

After setting the sensitivity to high or low, always verify by stopping and starting vibration for several times that the sensor operates successfully.

## 7. MAINTENANCE AND INSPECTION

In general, the sensitivity properly set VM needs no maintenance. But in order to use the sensor stable for a long time, maintenance and inspection is needed in periodic intervals.

### 7.1 Inspection

Inspection is held to examine

- if the sensitivity is set to proper sensitivity.
- if it is affected by the build-up.
- if the sensor is operating correctly.

Proceed as follows:

- (1) Make sure the measuring materials are not touching the detection rod.  
Replace the sensor out of the bin if necessary.
- (2) Supply power to the sensor.
- (3) Make sure which the sensor sensitivity was set, high, standard (shipping sensitivity).
- (4) Prepare the 0 to 10 V DC range voltmeter.
- (5) Plug in the positive reed to the test point 2 ( ) and negative reed to the ground terminal ( ).
- (6) See the table below. Ensure both (L or H) and (AJ.) stated voltage can be read for each set sensitivity. [ See the Table 7-1 below ]

Table 7-1

Set sensitivity	Position for sensitivity setting switch and voltage reading	
	( L or H )	AJ.
Standard	H: 8 to 9V DC	ADJ: more than 8 V DC
Low	L: 8 to 9V DC	ADJ: more than 8 V DC

- (7) If the voltage reading is accomplished, the sensitivity adjustment is correct. Nevertheless malfunction occurs, see section 8 for troubleshooting.
- (8) If the voltage reading is low, clean up the build-up on the detection rod. Then adjust the sensitivity volume in the state of sensitivity setting switch is ADJ until the correct voltage can be read. Nevertheless unsuccessful, the sensor is defective. Ask NOHKEN for repair/replacement.
- (9) If the voltage reading is high, the sensitivity adjustment is not proper. Adjust the sensitivity volume in the state of sensitivity setting switch is ADJ until the correct voltage can be read. Nevertheless unsuccessful, the sensor is defective. Ask NOHKEN for repair/replacement.

### 7.2 Maintenance

In order to use model VL for a long time, maintenance is needed in periodic intervals.

[ Maintenance method is as follows ]

- (1) A large amount of build-up on the tip of the detection rod will cause wrong signal output. Clean build-up in periodic intervals in case of measuring strong adherence materials.
- (2) Make sure the raindrops (water-drops) are not intruding inside the housing. In case of the outdoor use, the water-drops will intrude easily if the housing cover or the cable entry is loose. Intrude of the water-drops will cause an erroneous signals, so please make sure to tighten in an periodic intervals.
- (3) According to the measuring materials, the sensor will cause corrosion or rubbing. Make sure the corrosion and rubbing are not out breaking or progressing in periodic intervals.

## 8. TROUBLESHOOTING

Use the following chart to troubleshoot a malfunctioning sensor.  
 [ See the Table 8-1 below ]

Table 8-1

Problems	Possible causes	Remedies
Not detecting powders. (It overflow.)	Powder bulk density is too small. Bulk density under 0.2 cannot be detected.	Set high sensitivity.
	Power supply not connected.	Connect the power.
	Material too fluid.	Set high sensitivity.
	Effected by heavy hopper vibration.	Set high sensitivity or install the sensor in better location.
	Material has bridge or an angle of repose.	Install sensor in better location.
It keeps detecting powders. (Hopper was empty and the materials ran out.)	Heavy deposit on detection rod.	Clean detection rod.
	Material has dead stock.	Install sensor in better location or isolate dead stock.

If above remedies are unsuccessful, ask NOHKEN for repair and replacement.

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